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THE FORMATION OF USELESS HABITS IN TWO BRITISH NEWTS (*MOLGE CRISTATA*, LAUR., AND *M. PALMATA*, SCHNEID.), WITH OBSERVATIONS ON THEIR GENERAL BEHAVIOUR.

By Bruce F. Cummings.

Part 1.

The experiments and observations detailed below were made during the past year on two of the British species of Newt (*Molge cristata*, Laur., and *M. palmata*, Schneid.). In studying the formation of useless habits, I employed the labyrinth method, putting the Newts through a simple structure made of wood, and containing several choices between right and wrong. The labyrinth was submerged in a shallow water-tank, containing a small percentage of salt in solution (under one per cent.). A pinch of salt placed on a Newt's back sends it into paroxysms, ending in death, but the slight solution employed in the experiments was found to exercise no deleterious influences, though it brought about the required effect of general discomfort. In the late summer and autumn, when the Newts were leaving the water in preparation for the winter season, I was able to dispense with the salt, as the water alone provided a sufficiently strong stimulus to induce the animals to learn how to get out.

In each case the exit conducted the Newt out of the water in the labyrinth to the place where it had been accustomed to live, either to a pan of fresh water or to a vivarium. This piece of apparatus, though inexpensive, probably cannot be considered so effective as the employment of a battery, whereby the animals experimented on in a dry labyrinth are given a slight shock every time they take a wrong turn, the motive employed being the desire (only in the spring) to return to the water.

I.

Fig. 1 gives the ground plan of the first labyrinth used. It was made of wood, with the sides of each trough A, B, C 3½ in. high and sloping in, so as to prevent the Newts from climbing up the sides. Each animal was placed facing forwards at the beginning of the trough *a*. *Palmates* were employed in all the experiments except where it is specially stated to the contrary. An interval of at least ten minutes was given between each trial up to the end of trial 15, after which the interval was reduced to five minutes.

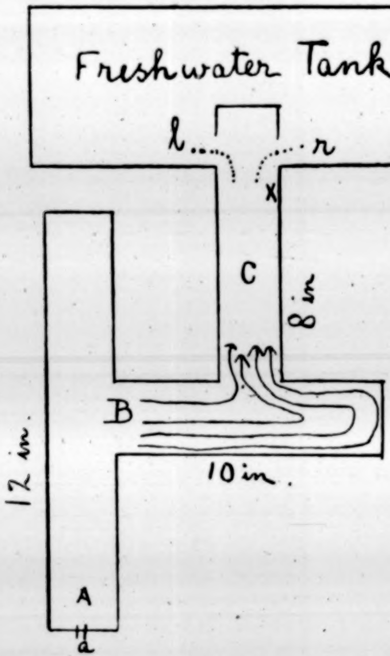

FIG. 1.—*a* = entrance, Trough A. Trough C slopes up from salt solution. *l*, *r* = left and right apertures into fresh water.

Table 4* (p. 170) shows that the first Newt reduced the

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* The times were reckoned from the moment the Newt began to move in the entrance until its nose reached the top of the slope at the exit.

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time occupied in traversing the labyrinth at the first trial from ten minutes to one minute twenty seconds in the 30th trial. After this greater irregularity and an increase in time are shown. The table must be supplemented by the following observations: During the first few trials the Newt wandered about the troughs aimlessly, eventually getting out by chance. At the end of the 15th trial the delay at the ends of the troughs where it "nosed" the barrier was less, and it had made a useless habit of wandering up and down A. Having once entered B, however, it walked to the end, and had formed a sure habit of turning left and so back along the side and into C and out at the exit. This behaviour was not owing to the fact that the animal merely followed the wall of the labyrinth all the way, as it frequently turned from the left to the right corner, and *vice versa*, at the end of B before finally going back by turning left. At the end of the 31st trial the Newt learnt to turn directly into C without going to the end of B, but it is interesting to observe that the habit grew gradually, by a process of "accretion," as Dr. R. M. Yerkes has called it,* *i. e.* the distance that it went beyond the opening to C towards the end of B became gradually less and less. This process is shown in Fig. 1; the routes

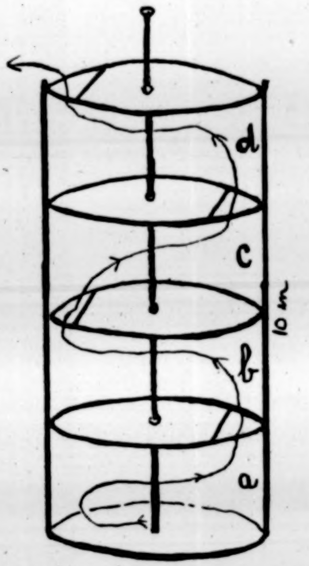

Fig. 2.—Diameter = 4 in.; greatest diameter of hole in each disk = 1 in.

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* Yerkes, R. M.: "Habit Formation in the Tortoise" ('Popular Science Monthly,' vol. lviii. p. 19).

plotted do not, of course, represent those followed in successive trials.

As I expected, it never learnt to traverse the labyrinth perfectly, and up to the end of the 50th and last trial the Newt had formed a useless habit of wandering up and down A before taking the turn into B. A great deal of energy and time was wasted in trying to get out by climbing up the sides of the trough. The Newts always showed an astonishing persistence in this; its relation to the forming of correct habits I shall mention later on. What I wish particularly to emphasize is that throughout the whole of my work I observed a strong tendency in the Newts to form useless habits, from which no pleasurable results accrued. In some instances, which I shall describe, the habits formed were most elaborately wrong. In trials 10 to 19 the Newt made a habit, on first walking up A, of entering the mouth of B for a couple of inches, and then withdrawing again into A, and so on to the end of it, where, after some delay, it used to turn to the left down to the entrance barrier and up to the mouth of B again. On entering it the second time it went on, and finally out at the exit. Then, again, in trials 42 to 48, the Newt, when it had reached a certain distance up C, always stopped and placed its nose into the right angle formed by the floor and side of the trough. But there was *no gap in the join and no inequality* which could have produced a stereoscopic reflex.

All my results show the ability in the Newt to form rapidly simple habits of turning right and left; thus, at the end of fifteen trials this first Newt always turned to the left in B, and from trials 20 to 38 it escaped by the left aperture of C with only one exception. Occasionally it would walk up C on the right side, but on reaching a point *x* (Fig. 1) it would walk right across to the left, although it could have got out equally well by turning right. Once it turned across from right to left too soon, so that it struck into the left side of trough C instead of at the exit. After a pause the turn to the left was accentuated, so that it almost faced back toward B. Finally, with hesitation, it went forwards and out as usual on the left. The animal probably did not cross from right to left simply because it saw the opening on the other side—that would mean an intelligence far too quick for the sluggish Newt—but the instant when to turn was *partly* indicated by vague motor sensations, by a feeling that it had got up as far as where it had been accustomed to turn, when over on the left side. Sight cannot be entirely left out of consideration, however, although it need not necessarily play any part in helping the Newt to learn the labyrinth.

At the end of the 15th trial, when it had learnt to go around to the left in B, I transposed the two troughs A and B. The troughs were *precisely alike* except in length, and the Newt on going to the end of A (*in the* B *position*) turned to the left; then a short pause clearly indicated that it was puzzled by the greater length of the opening into C from the end of A. It went on and entered C, but had not gone far when it turned back. The reason for the turning back may very well have been because it thought it was still back in A (*in its original position*), and that C was B, for I have already said that it had formed a habit when first entering B of turning back. Such an illusion was caused by the difference in length of B and A. The experiment also shows that the clue which enabled it to know when to turn to the left at the end of a trough, and to expect the mouth of C a little way back from the end, was the sensation of having previously made a turn to the right, *i.e.* from A into B. The Newt also "felt" when it had gone sufficiently far to meet with the opening into C.

A great deal of time was always wasted by the Newts throughout the course of the experiments, as they invariably turned round and "nosed" the barrier on being first introduced to the labyrinth. On the surface, this behaviour looked exactly as if they realized that they were being pushed through a hole into a trough, and that they inferred from it the precise position of the hole. Here, again, this would be assuming, I believe, too much mental activity in the Newt, and, as a matter of fact, the explanation lies in the well-marked withdrawing response which the Newt gives when confronted with any unpleasant situation, such as bright light, heat, or, as in this case, salt solution. They instinctively shuffle back, and then make a *volte-face*.

II.

Fig. 3 shows the next maze which was used—a very simple structure, offering only one choice. Previously it was found that if the labyrinth was fitted with two exits, one in each passage, and both equally negotiable by the Newts, they showed a slight tendency to prefer to get out by the left one. Of thirty separate Newts tried in succession, eighteen got out on the left and twelve on the right. The left, therefore, was made the *cul de sac.*

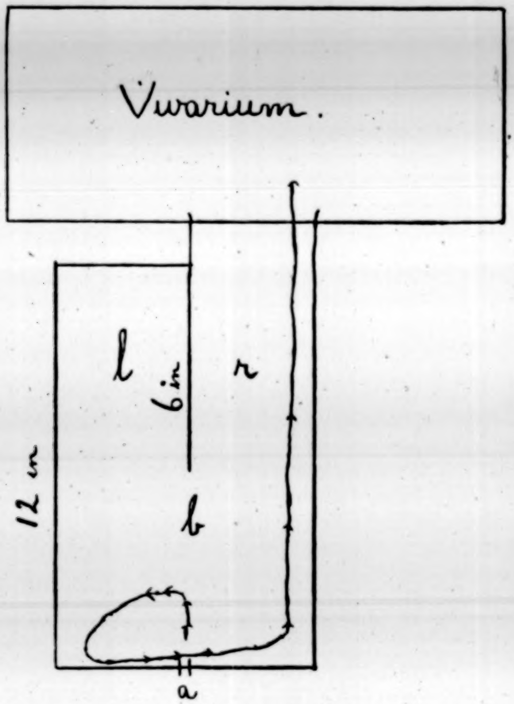

FIG. 3.—*a* = entrance to *b* = the labyrinth under water; *l* = *cul de sac*; *r* = sloping path leading up out of the water. The arrows indicate Newt's courses.

Great Crested Newts were used for this experiment. An interval of ninety seconds only was given between each trial.

TABLE 1. NEWT, NO. 1.

No. of Test.	Time occupied.	Route taken.
1.	*5 min. 29 sec.*	Entered *r*, back and about *a*, and finally *r*.
2.	3 min.	*l*, *a*, *r*.
3.	2 min. 33 sec.	*r*, *a*, *r*.
4.	3 min. 2 sec.	*l*, *a*, *r*.
5.	2 min. 30 sec.	*r*.
6.	30 sec.	*l*, *a*, *r*.
7.	1 min. 29 sec.	*r*.
8.	2 min. 5 sec.	*r*.
9.	2 min. 7 sec.	*l*, *a*, *r*.

TABLE 1.—(*continued*).

No. of Test.	Time occupied.	Route taken.
10.	30 sec.	*r.*
11.	52 sec.	*r.*
	Interval of 20 min.	
12.	*6 min. 34 sec.*	*l, a, l, a, r.*
13.	42 sec.	*r.*
14.	1 min. 22 sec.	*r.*
15.	1 min. 20 sec.	*l, a, r.*
16.	2 min. 30 sec.	*l, a, r.*
17.	35 sec.	*r.*
18.	32 sec.	*r.*
19.	1 min. 11 sec.	*r.*
20.	24 sec.	*r.*
21.	1 min. 52 sec.	*r.*
22.	1 min. 27 sec.	*r.*
23.	1 min. 4 sec.	*r.*
24.	6 min.	*l, a, l, a, r.*
25.	15 min.	*l, a, l, a, l, a, r.*

This table shows that the Newt had formed a correct *r* habit at the end of trial 17, and it is worth remarking that it always oriented itself by "nosing" the left corner, then turning continuously left to the right corner, and up the side into *r*, and so out. The reason for the complete disintegration of the habit at No. 24 was that it had started for the first time in that trial to climb up the sides, and it apparently found the exercise so stimulating that it continued to do nothing else afterwards!

TABLE 2. NEWT, No. 2.

No. of Test.	Time occupied.	Route taken.
1.	*4 min. 30 sec.*	*l, a, r.*
2.	2 min.	*r.*
3.	6 min.	*l, a, l, a, r.*
4.	30 sec.	*r.*
5.	2 min.	*r.*
6.	59 sec.	*r.*
7.	5 sec.	*r.*
8.	12 sec.	*r.*
	Interval of about twelve hours.	
9.	*2 min. 29 sec.*	*r* (after hesitation).
10.	5 sec.	*r.*
11.	21 sec.	*r.*
12.	—	—

Table 2 proves that No. 2 learnt the correct habit after only three trials. No. 3 diminished its time and mistakes, but had not formed a perfect habit after twelve trials. No 2, like No. 1, did not go straight to *r*, but around by the left from the left of *a*.

Table 3. Newt, No. 3.

No. of Test.	Time occupied.	Route taken.
1.	*21 min. 30 sec.*	*r, l, a, r, a, r, a, l, a, r, a, r, a, l, a, l, a, l, a, l, a, l, a, l, a, l, a, r.*
2.	5 min.	*l, a, l, a, r.*
3.	1 min. 30 sec.	*l, a, r.*
4.	6 min.	*l, a, r, a, l, a, l, a, l, a, r.*
5.	18 sec.	*r.*
6.	1 min. 10 sec.	*l, a, r.*
Interval of about twelve hours.		
7.	*8 min.*	*l, a, l, a, l, a, l, a, l, a, r.*
8.	11 sec.	*r.*
9.	1 min. 29 sec.	*l, a, l, a, r.*
10.	24 sec.	*r.*
11.	30 sec.	*l, a, r.*
12.	2 min.	*l, a, l, a, r.*
13.	2 min.	*l, a, r.*
14.	3 min.	*l, a, l, a, r.*
Interval of ten hours.		
15.	*9 min.*	*l, a, l, a, l, a, l, a, r.*
16.	29 sec.	*r.*
17.	10 sec.	*r.*
18.	out instantly	*r.*
Interval of thirty minutes.		
19.	*7 min. 30 sec.*	*l, a, l, a, l, a, l, a, r.*
20.	45 sec.	*r.*
21.	out instantly	*r.*
22.	65 sec.	*l, a, r.*
23.	10 sec.	*r.*
24.	15 sec.	*r.*
Interval of thirty minutes.		
25.	*8 min. 3 sec.*	*l, a, l, a, l, a, r.*
26.	60 sec.	*r,*
27.	90 sec.	*r.*
28.	out instantly	*r.*

Table 3, giving the rest of the trials made with the at first incorrigible No. 3, shows that it had formed a correct *r* habit at

No. 16, which became partially disintegrated after a thirty minutes' interval, but was very rapidly re-acquired. Three more Great Cresteds were tested, the trials succeeding each other at the same pace with periodic intervals. They all showed rapidity in forming the simple *r* habit of movement, and equal rapidity in losing it. Another was tested *at intervals of fifteen minutes*, and at the end of twenty successive tests completely failed to form any *r* habit.

The Newt's capacities for forming simple movement habits were also tested by putting them in salt solution contained in narrow bottles with variously shaped necks. A glance at Fig. 4 shows that the trick to be learnt was a reversal of their position, and then out at the top. The first bottle was learnt, on an average, after three trials. The first trial always showed the Newt persistently "nosing" the bottom. The second and third usually saw the time reduced to its smallest limits. The time occupied in the initial "nosing" in No. 1 trial varied a great deal, but rarely exceeded three minutes. It is all the more surprising therefore to find that a certain male of *M. cristata* nosed the bottom for forty minutes, after which more salt was added, with the result that it shot out quickly. The second trial occupied sixty-two seconds; No. 3, three minutes forty-five seconds; No. 4, twenty-five seconds; after which the time was reduced, in two more trials, to the minimum. The fact that this particular Newt was very thin and emaciated is suggestive. The necked bottles made very little difference in the rapidity with which the Newts learnt to reverse, the trick being acquired in from five to six trials as a rule.

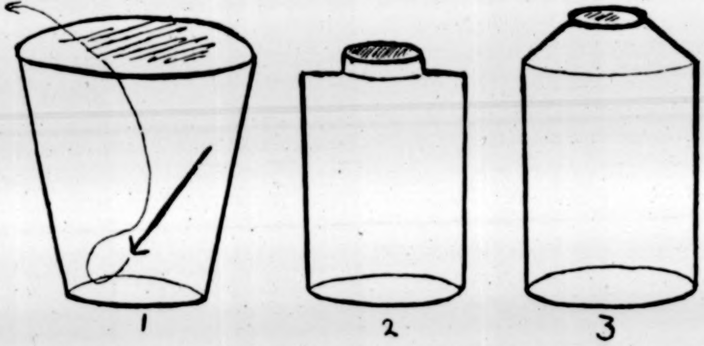

FIG. 4.—Height of each bottle = 6 in. Diameter at the bottom = 3½ in. to 4 in.

In some cases the Newt, in the first trial, *immediately* got out; in others, it attempted to reverse at once, but was unable until, after the practice of several trials, it had learnt to bend its body circularly, or, as was the habit of some, to force themselves up straight without bending. Intervals of two minutes were allowed between each trial; it was again seen that these simple movements were readily lost after intervals of sixty, forty-five, twenty, and ten minutes. I observed, however, that the Newts showed unmistakable signs of the influence of their previous training, although this more rapid re-acquirement would not be shown on paper by giving the time records.

TABLE 4.

No. of Test.	Time.	No. of Test.	Time.
1.	10 min.	20.	10 min.
2.	1½ min.	21.	4 min.
3.	2 min. 30 sec.	22.	8 min.
4.	3 min. 20 sec.	23.	2 min.
5.	30 sec.	24.	2 min.
6.	5 min.	25.	3 min.
7.	13 min. 30 sec.	26.	3 min. 10 sec.
8.	4 min. 20 sec.	27.	1 min. 30 sec.
9.	6 min.	28.	1 min. 10 sec.
10.	10 min. 30 sec.	29.	4 min. 30 sec.
11.	4 min. 10 sec.	30.	1 min. 20 sec.
12.	5 min. 50 sec.	31.	5 min. 40 sec.
13.	14 min.	32.	12 min.
14.	5 min.	33.	8 min.
15.	7 min. 20 sec.	34.	2 min.
16.	2 min. 30 sec.	35.	7 min. 30 sec.
17.	8 min. 30 sec.	36.	7 min.
18.	4 min.	37.	2 min. 30 sec.
19.	4 min. 40 sec.	38.	3 min.

III.

One form of labyrinth used was a spiral, which was placed vertically in a large glass jar (see Fig. 2, p. 163). Table 5 gives the particulars.

This labyrinth took advantage of the Newt's "nosing" instinct, as all it had to do was to "nose" the roof of each storey until it hit the opening. The learning of the maze also involved nothing but the Newt's motor sensations and the sense of touch, as the senses of hearing, taste, and sight could be neglected, especially the latter, because the light was made to play as evenly as possible on all parts of the glass jar, and on more than one occasion the Newts showed that they did not really *see* their way up, for they would "nose" along the roof to the very edge of the opening in it, and then draw back again. *M. cristata* was the species used.

TABLE 5.

No. of Test.	Time.	Observations.
1.	4 min....................	Nosed in each storey.
2.	2 min. 30 sec.	
3.	1 min. 30 sec.	
4.	4 min.	
5.	2 min. 20 sec.	No nosing in *c*.
6.	3 min. 5 sec..........	
7.	4 min. 39 sec.	
8.	4 min.	Pronounced nosing, especially in *b* and *d*.
11.	2 min.	Only nosed in *b*.
12–20.	1 min. 30 sec.–4 min. 15 sec.	Nosing only in *b* and *d*. Walked always to the left of the pillar in *c*. In No. 19 it rose in right corner of *c*, contrary to custom, but it crossed over to left. The same thing occurred in No. 20.
21.	1 min. 50 sec.	Rose in right corner of *c*, and went to the *right* of pillar to the end of No. 40.
25–31.	1 min. 55 sec.–3 min.	In *b* went left of pillar, in *c* right, and in *d* left. Nosing very reduced,
32.	2 min. 55 sec.	Delayed in *b*, nosing, and went right. Similarly in Nos. 33 and 34.
35.	1 min. 15 sec.	In *b* went left, *c–r* (right), *d–l* (left). Nosing in *b* and *d*.
36.	4 min. 44 sec.	In *b–r*, *c–r*, *d–r*. Nosing badly.
37–40.	1 min. 20 sec.–4 min. 5 sec.	In *b–l*, in *c–r*, in *d–l*. Nosing less.
41.	3 min.	In *b–l*, in *c–r*, in *d–r*. In *d* turned as if for left, but fell into right corner, and so around.
42.	3 min. 30 sec.	In *b–l*, in *c–l*, in *d–l*. Nosing badly everywhere.
43.	8 min.	In *b–l*, in *c–l*, in *d–r*. Nosing badly.

Table 5 gives the results of an experiment with a Newt which first of all was placed in the water of the jar when the labyrinth was immediately slowly pressed down upon it into the jar. The animal was placed facing directly away from the opening leading from the lowest storey *a* to the next *b*. It would first begin to nose the roof of the first storey, going round after a delay either to the right or the left corner, where it would rise and immediately re-begin nosing in *b*. After at first a lengthy delay it would nose around to the second opening, going either right or left of the pillar. And so with the other storeys, the last one leading it out into its vivarium home. The table shows that the Newt at the end of the 25th test had formed an almost perfect habit of climbing up through the spiral without making any delays by persistently nosing at one place as previously. Later, nosing set in again, in an acute form, perhaps the result of fatigue and the consequent relaxation of inhibitive control of its instinctive stereoscopic nosing responses. The trials lasted over four days, and fifteen minutes' interval was allowed between each trial. It should be understood that the Newt never learnt to climb up the spiral, without *any nosing at all*; it nosed its way all round the spiral, but showed its capacity for learning and inhibiting by not wasting time in nosing in one place only. It kept on the move in the right direction.

The table also shows that the Newt early formed a fixed habit of going to the left of the central pillar in *c*, and it is important to observe that it was in *c* that it first learnt to cease making any delay through nosing. Further, it will be seen that in general as the nosing becomes less in the three storeys, so fixed habits crystallise out. For example, a left-right-left habit was formed in the three succeeding storeys *b*, *c*, *d*, after delays had been cut out. In 32 it nosed in *b* and went right. See also 36, 42; and, although it is not shown, the whole of the tests up to about 20 gave no regular habits, right or left, in *b* and *d*, because it was in these two storeys that the Newt delayed, always nosing with a persistence which, if it had been intelligent, would have been called "determination," but, being useless and unintelligent, must be described only as "stubbornness." These habits of movement right or left are significant, for it is to be observed that the animal could always attain its end equally well by going either side of the pillar.

That the habits of turning had intimately insinuated themselves into the Newt's nervous system was shown in trials 32, 33, 34, and 36, where the Newt turned according to habit, although it had, at the beginning in *b*, made a wrong turn which, on account of the structure of the labyrinth, was bound to alter the circumstances of the other turns, in this instance leading the Newt up into *c* on the *right* side instead of on the *left*. In 32, 33, and 34 also the *d* turn was correct as well. No habit, however strong, seems to be able to form and permanently withstand the disintegrative effects of the strong nosing instinct. Similarly with its impulsive side-climbing in the other labyrinth.

The times in the table do not signify much, as a Newt would sluggishly traverse the spiral with no mistakes, while an energetic control would invariably get through much quicker, yet it made, of course, every mistake possible.

IV.

Other labyrinths were tried, but no Newts learnt them permanently, on account, as in the others, of the climbing propensities. Several Newts, however, presented interesting aspects in their behaviour, and one, a Palmate, formed a useless habit, lasting over a period of nine trials, of climbing up the side of the corner of a trough, nosing the glass top over the trough (only two inches up in this case), until it overbalanced itself and fell into the exit trough, and so out. All this, and it might have simply turned and got out in half the time! The same Newt, over the same period of trials in the same labyrinth, formed two other habits. In the first, it would always return to the mouth of the first trough and retire again to the next, eventually entering the first completely down to the entrance barrier, and then going forward to the third trough (omitting the second), out of which it fell, in somewhat the same way as in the last trough already detailed.

The most remarkable case of the elaboration of useless habits occurred in the labyrinth, Fig. 5, which somewhat resembles the labyrinth used by Dr. Yerkes for testing the learning powers of the Frog.* A male Palmate, in trials 16, 17, 18, entered *r*, and in pursuance of a curious habit (somewhat similar to what occurred in other labyrinths with other Newts, as I have described) withdrew when about two inches in. In Nos. 18 and 19 it had formed another habit of turning a complete circle to the right when in *l*, starting from a position facing the blind end. Finally, in 19, an additional habit was made of returning to *l* again, just after leaving it, when it had reached only half-way down to the entrance barrier. In 20 all these useless habits appeared *en masse*, as is indicated by the dotted line of the Newt's route. In 21 the same course was made, with the elimination of the *r* habit, although it clearly hesitated, and made as if to turn, but went on.

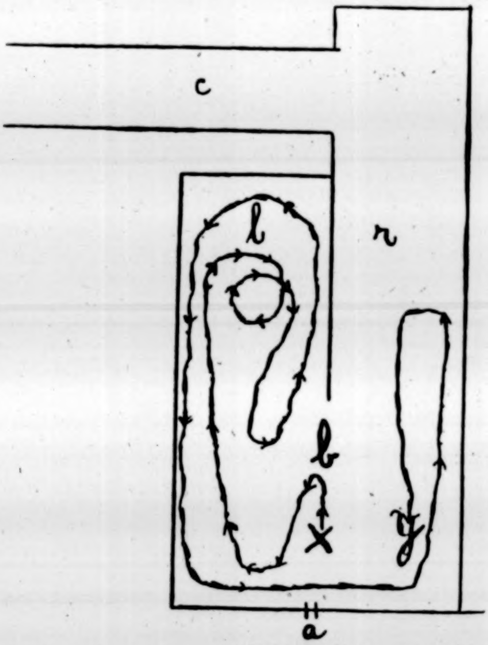

FIG. 5.—*a* = entrance to *b* = the labyrinth under water; *l* = *cul de sac*; *r* = passage leading to *c* = slope from water up to vivarium; *x* = the start of Newt's route; *y* = the finish.

In the same labyrinth I obtained a good instance of the struggle for existence of two distinct habits. A strong *l*, *r* habit had been formed, in which the Newt climbed up in the *l* box at a certain spot on its right side, so that, by climbing and moving slightly to the right, it was able to fall out and across the entrance of *r*, into which it turned. The next day it merely walked out of *l*, but on the left side, and *inclined towards r* between *x* and *y* in the figure. It did not turn into *r*, but around by *a*. The second trial, the same route was taken. I have no record as to what happened on the third, but on the fourth it went through the climbing process and fell out, and for the first time immediately turned into *r*. Precisely the same thing happened in the next trial, but afterwards the *l*, *r* gradually gave way to the *l*, *a*, *r*. The "fall out" appeared to revive the habit of the day before, which a new habit finally overcame.

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* Yerkes, R. M.: 'Harvard Psychological Studies,' vol. i.

(To be continued.)

AN OBSERVATIONAL DIARY ON THE NUPTIAL HABITS OF THE BLACKCOCK (*TETRAO TETRIX*) IN SCANDINAVIA AND ENGLAND.

By Edmund Selous.

(Part II. England.)

(Continued from p. 56.)

May 5th, 1908.—Arrived yesterday, and was driven to one of the Blackcock *leks*, in the afternoon, by the keeper, who arranged to call me at my lodging, at 3, the next morning. He was late, however, so that we did not get to the place quite in time. There were some four or five to half a dozen male birds there, and as I came up, now in a drizzling rain, I could see them springing at one another. In getting into place, behind one of several thinly scattered thorn-bushes, I probably disturbed the birds, who went up, and flew to a little way off, but as they returned, very shortly, and remained upon the open, somewhat swampy, space chosen by them, for more than an hour, seeming quite at their ease all the time, they could not, I think, have been much alarmed, even when they went off. But there was, now, no further fighting, or, indeed, any activity at all, the birds merely standing quietly, without doing anything, which I attribute, and hope may be attributed, to the rain, which had come on more and more, nor was there any intermission in it, till the meeting broke up. This morning, then, was quite a failure.

May 6th.—Started off, in the dark, on my cycle, about 2.15. Yesterday I had ridden the keeper's horse, for half the way, going turn and turn about with him, but pushing the cycle up the long steep hill which has to be surmounted in order to get to the place—on the side of a higher hill—was a different matter. However, I was on the spot, and seated behind the gorse-bush I had chosen, yesterday, some little time before 4, and before any birds had come. It was about a quarter of an hour later, and when the light was still very dim, that I began to hear them, and, from the sounds, judged that a good many—perhaps a dozen—cocks were assembled. Besides the peculiar harsh grating note which seems so well fitted to express anger, there was that soft, plaintive one which sounds quite opposite in character, but is really far more its concomitant, since it is generally, if not always, uttered when two birds stand opposite one another, and seem on the point of engaging, though, whether through nervousness, or lack of courage, it is seldom that they actually do engage. Most noticeable, however, and continuous, was the pretty, musical "whirbling" (as I have called it), whether more subdued than when uttered in Scandinavia, under exactly similar circumstances, I am not quite sure, but certainly far more so than as the birds there produce it, when perched amongst the fir-trees, for here on the moors trees of any kind are wanting. As it grew lighter, by degrees, I saw the white tails of the cock birds flashing here and there, through the gloom, and then the rich, deep black of the general plumage, against which, like the wing-plumes of the Ostrich, they stood beautifully out, till, at length, the whole bird, and all his actions, became plainly visible. These consisted of advances, with spread tail, towards one another, more or less swiftly, along the ground, with occasional excited leaps into the air, just as, last year, in Sweden, but here, as there, I saw nothing of that sustained and exaggerated energy which upon some, though, as I begin to think now, only exceptional occasions, renders this performance so extraordinary a one.

It was not till a good deal later, when the light of day had properly asserted itself, that either hen birds began first to appear upon the scene, or I first to notice them. These were courted by the cocks in the same manner as described in my notes of last year, but a new and interesting feature was now present, or observable by me, for one hen would often chase another furiously over the course, and, on at least one occasion, two fought together, spreading out their tails and leaping at each other, like more slightly made cocks. In the chase they ran with great speed—much greater, it seemed to me, than I have ever seen attained by a male—and, stretching their bodies forward and upward, became much slighter- and thinner-looking. I was lucky in, more than once, seeing the occasion and meaning of such pursuits and flights. Thus, with wing lowered upon the side towards her, and with his whole body tilted in the same direction, with tail turned so as to show its full outline, the white of it being splendidly conspicuous, and with lowered bull-like head, a fine cock bird—though they were all fine—was making little swelling runs, in curves, backwards and forwards, about the object of his desire, who, on her part, would make a funny little run, and then stop, then run and stop, again, and so on, showing most plainly, as any actual observer, I think, must have recognized, that she understood the significance of this courtship well enough. At any moment she could, had she pleased, have flown or run right away from it, but, thus moving, and keeping, first, in one direction and then in another, within a certain limited area, which was very conspicuous to me, she preferred to let it continue. All at once, another hen came into this same area, and within a few yards of her, upon which, with every sign of jealous rage, she precipitated herself upon this conscious or unconscious rival, who, surrendering forthwith, fled for life, and was chased right away, each bird exhibiting, as I say, very great speed. Here then the very essence of the drama was clearly unfolded before me. No hen bird could act, under such circumstances, in so furiously aggressive a manner, and yet be indifferent to the male's advances, and this, if that strange myth of the hen's indifference* still survives, makes the observation here recorded a valuable one, nor, as I say, did it stand alone. On the one or two occasions on which hen birds positively fought, I imagine that the cause was the same, without similar yielding on the part of one of them, but I did not see this with my own eyes. Nothing could show more plainly what these meetings represent, for both sexes, than this combative mood of the hens.

It was when one cock was courting a hen, and the movements of the latter brought him near to another, that a combat was most imminent. In such cases the first bird would rush out towards the one approached, who, on his part, might advance to meet him, or himself to court the hen; yet I witnessed only one determined fight. Here the birds sprang at each other, with fury, and the buffetings which they bestowed with their wings made a loud noise. It, however, lasted but a short time, nor were the general features of the campaign other than as in Sweden, *viz.* much threatening and fronting one another, with the curious plaintive-sounding cry, but mutual chariness in beginning. I saw only one actual pairing (coition), but, except that the hen gave voluntary signal for this, I did not catch the circumstances that led up to it. The assembly-ground was only some thirty or forty paces from where I sat, and looked down upon it from a slight elevation. Except for some tufts of grass, there was nothing to hide the birds, but much of the space was quite open, and, on the whole, a better view could hardly have been obtained.

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* I do not, of course, mean that any hen bird may not, upon any occasion, and for various good reasons—such as hunger, satiety, or a preference elsewhere—be indifferent to this or that male—even the favoured one; but only that the indifference of the female to masculine courtship, *as such*, is a myth.

May 7th.—First "whi-i-i-ish" note at 3.30 a.m., followed almost immediately by the plaintive "chirrer" one, and then the whirble. I am, therefore, only just in time, having taken my seat some five minutes before, when everything was still, though I put up one bird as I walked over. For the rest, this morning is but a repetition and confirmation of yesterday. The hens are assiduously courted by the males, and they occasionally fight, spreading out their tails when they do so, which are then seen to have some white in them, as well as those of the cocks. But this is confined to the tips of the feathers, which appear as little white spots, running round the circumference of the fan—at least the eye distinguishes no more. One hen also is sometimes chased away by another, which means, of course, that there would be a fight did not this other flee. For the rest the hens seem hard to win, and I only saw one case where a cock was successful in his desires. A tuft of grass, indeed, hid the actual sight of this from my view (as it may have done in other cases), but there could be no mistaking the conduct of the hen, when she emerged from behind it, consisting, as it did, of several very satisfied little motions, ruffling and shaking the feathers, and then a vigorous preening, of which there had been no hint before, nor was it in the order of things.

Though, as I say, the hens seem hard to win, yet they look quite conscious of being courted, and the fact that, as a resultant of this, pairing does, from time to time, take place, as well as their jealousy of one another, is proof that they are not indifferent, although they may be nice. That they should be nice does not appear to me to speak against, but rather for, the hypothesis of ~~[illegible]~~ sexual selection, for as the males became all more attractive, the hens should become more critical—the one factor could not operate without the other. So, too, the hens appear to be won by courting, and not by fighting. This was so in the one case of coition observed by me this morning and yesterday, for though, as I say, I did not happen to have my eyes on those particular pairs, rather than others, just before it, yet fighting even to a moderate extent must certainly, on so confined a space, have caught my attention. Moreover, on the whole, there is but little fighting amongst the cocks—at any rate, it is not nearly so important a feature as seems to be generally imagined. For the most part, the birds threaten merely, and, even when they do close, it is but seldom that one hears the loud flaps and buffets with the wings, that give evidence of any considerable fight, nor do they last for any time when one does hear them.

Though the cocks court the hens in a very business-like manner, and, as one may say, patiently, yet they sometimes lose patience, and make either a little run or a little spring at them. I have seen one instance of the former and two of the latter, but not once was the attempted ravishment, as it seemed to be, successful. In the first instance, the hen ran, and, in the two last, she flew away.

The monosyllabic, barking cry of the hen—like that of the hen Capercailzie, but much less guttural—was a good deal in evidence this morning.

May 8th.—Left the cottage at about 2, and was seated well before 3.30, at which time everything was still as death. In ten minutes or a quarter of an hour, the first notes of the cocks were heard, and for a long time, as far as I could see or hear, they were on the place by themselves, without any hen. They would either stand, for some time, more or less quiet, or else whirbling; or, with a little jerk upwards, and flap of the wings, they would bring out the angry "whush," or this jerk would be exaggerated into a more or less high leap, which, again, would sometimes pass into a short flight from one part of the arena to another.

Besides the above-mentioned actions, one bird would often run at another, sometimes for nearly the whole length of the ground, or two would so meet, and then stand fronting, and threatening to leap at, one another, which, however, they but seldom did, nor was there anything that really deserved the name of a conflict. Here, again, we have something very different from the popular idea of these things, which supposes continual violent conflicts between rival males met to court and fight. Instead—here as with the Ruffs—such conflicts are few and far between, and, when they do take place, last but a very short time—often not more than a few seconds. The birds seem simply to lack the courage to fight. They come on with every appearance of rage, then stop, face to face—almost always with that peculiar note so different in sound and character—turn about, stand with dilated feathers, and bent heads, side by side, front one another again, make an abortive half-spring, think better of it, and then separate, one or both returning from whence they came. They do everything, in fact, *but* fight, but in that they make a very tame and poor figure. Still, if they actually do make a spar or so, it is with all the violence that could be wished, but the flame that has leapt suddenly up expires as suddenly. Now and again, indeed, there is a fight of some twenty seconds or so—even perhaps a minute—and then it makes a fine show. But, after all, what is it in itself compared to the furies of Sparrows or Blackbirds, of a pair of Tits, or to those long rancorous combats of the Redshanks or Kentish Plover which I have witnessed and described?[*] It is only because of their size and bold plumage that it makes a superior effect. Dress them in drab and reduce them by half or a quarter, and there would be little to say of it. I am speaking, of course, to the extent of my observations, but it seems strange that those made in Sweden and here should so tally, if they do not represent the general rule. In Norway, too, it must be remembered—I shall never forget it myself—that the very bird that made such a prodigiously warlike display slunk quietly away, a poor tame thing, on the entry of another male into the arena.

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[*] *Cf.* "Observations tending to throw Light on the Theory of Sexual Selection" in 'Zoologist' for June, 1906. &c.

It was some time, this morning, before I perceived first one, and finally two hens, which were courted by the various cocks as they passed over the ground, in the usual way. This led to some furious rushes, and a spring or two, between bird and bird, but even now there was nothing heroic. To the courting actions which I have already described, another is now to be added—which I also saw several times yesterday—the sinking down, namely, of the male before the hen, and remaining so, for some seconds, with wings slightly expanded and touching the ground—the prostration, in fact, of the Ruff, but not so pronounced. For the hens, they walked, warily, about amongst the males, for the purpose, apparently—it is difficult to think of another one—of being courted by them. From time to time one would crouch before her admirer, but I only saw one case of actual coition, and it is significant that this took place in precisely the same spot—behind the same tuft of grass—as it did yesterday; presumably, therefore, with the same male bird, since the latter, on the whole, have their special places on the courting-ground. Immediately afterwards two other cocks came rushing up in a great state of excitement, and the three swelled and bustled about together, but here, too, there was no actual fighting—not even a blow or two. Soon after this the hens left, and the business of the morning seemed over, perhaps damped by the perpetual, sharp, pelting rain. Most of the cocks, too, soon flew off. I had never been able to count more than six, at one time, on the ground, but as, when I rose to go, four more flew up, there must really, I suppose, have been a greater number—perhaps eight—but not, I think, more than that, together.

At 6 I met the keeper, by appointment, at the foot of the hill, and went with him to be shown "a noted place" for the assembling of Blackcocks, just off a long, lonely road over the moors. It was another weary toil, almost all up hill as before—(so that the cycle helps little except to come back)—and as far again as I had come. Having got there I marked the place with a small heap of stones, and purpose to come again to-morrow before light, starting about 12.

(To be continued.)

NATURAL HISTORY RECORD BUREAU (1909): THE MUSEUM, CARLISLE.

By D. Losh Thorpe & Linnæus E. Hope, Keepers of the Records.

In the report from this "Bureau" for last year (1908) we referred to the visits of a wild Whooper Swan to the River Eden, and hazarded the opinion that this bird had not yet paired, and that it would be interesting to see what might happen when that important incident in the life of a bird took place. Wild Swans, it is believed, pair for life, and for that reason we felt that if our bird was a female, as we imagined, her mate would be induced to follow her to her winter quarters. This has really happened, and more, for the pair are accompanied by two more birds of the same species—not a brood, but adult companions.

These four Wild Swans arrived on the Eden on the morning of Dec. 24th (Christmas Eve), and were immediately reported by the park-keeper, T. Hudson. Mr. D. Losh Thorpe saw four Swans flying towards the river from the north-east at the hour they were seen to arrive by the keeper—no doubt the four Wild Swans.

The presence of four Wild Swans, or even of one, in such close proximity to the haunts of men is, as we have said before, most extraordinary, Wild Swans being amongst the shyest and most suspicious of wild animals. Carlisle is indeed a favoured place, the honour of entertaining such distinguished visitors being afforded to few places; such an occurrence has never before been recorded in this country. Several other interesting occurrences are reported during the past year.

Mr. D. Losh Thorpe records a bird new to Cumberland—the Stone Curlew, or Great Plover. A bird of this species was seen by him on the banks of the River Eden, at Caldew Foot, on the morning of March 27th, 1909.

The date of the occurrence coincides with the arrival of the species in the South of England this year. It was evidently a bird which had over-reached the usual northward migration limit, and was resting and refreshing itself by the river. It had gone later in the day, as a careful search failed to again reveal it. The Stone Curlew is a most interesting bird ; we have kept it in captivity, and have studied its habits in its breeding haunts in Norfolk. It is not a common bird in Britain, and is extremely restricted in its distribution in this country, there being only a few favoured spots in the South of England where it is to be found breeding.

Another extremely rare bird in the district (the Wryneck) was killed by telegraph-wires near Drumburgh on June 27th, 1909. James Smith, who dissected the bird, said it was a female, and had evidently been nesting. The Wryneck has only been recorded in two instances in Cumberland during the last fifty years, but T. C. Heysham records it as breeding regularly near Carlisle in his time.

A new bird has been added to the Westmorland list—the Golden Oriole (*Oriolus galbula*). An immature male bird of this species was picked up dead in the vicarage garden at Brathay, near Windermere, on May 16th, 1909, and sent to the Carlisle Museum by the Rev. T. H. Baines, who said it had been seen on the previous day by his neighbour, Mr. Whitwell. Six degrees of frost were registered on the night of May 15th, and this no doubt was responsible for the death of the rare and delicate straggler.

In the early part of the year (Jan. 2nd) a flock of Snow Geese were reported to have been seen on the Solway. They were flying west, and were seen near Annan by two gentlemen, who had a good view of them as they flew close over the golf-course. The visits of this Nearctic species to the Solway have been few and of short duration ; there has never been any possibility of obtaining an example to fully authenticate their occurrence. Wild Geese were again numerous on the Solway marshes, and six species were reported on the Cumberland side, *i. e.* Grey Lag, Bean, Pink-foot, White-fronted, Barnacle, and Brent. The Grey Lag has been fairly numerous; in fact, Mr. W. Nichol says that in his locality more Grey Lags than any other species were killed, the next in point of numbers being the Barnacle. The Pink-foot is, however, the predominant Grey Goose, and the White-fronted the rarest. The Barnacle is not quite so numerous as it was ten years ago.

Two interesting Ducks were obtained on the Solway in early winter, one being an adult male Garganey, a bird not often met with on the Solway, in full eclipse plumage—an interesting stage of plumage; the other an adult male Long-tailed Duck in full winter dress. The latter species has occurred fairly regularly on the Solway since 1884, but this is the first time it has been obtained in this dress, and it is also noteworthy that the date (Nov. 2nd) is extremely early for the assumption of the full winter dress.

The summer visitors, as a whole, were much earlier in 1909 than in the preceding year, despite the cold spring and late frosts which lasted into June. The first Wheatear, which is our earliest migrant, was noted on March 25th, as against April 4th of 1908. The Swallow was seen six days earlier, and the Sand-Martin ten days earlier. The Willow-Warbler was reported three weeks earlier than in 1908. The Cuckoo, Corn-Crake, and Swift were each ten days earlier, and the Chiffchaff eight. There is still much to learn respecting the migration range of our summer visitors, and we do not yet know to what extent local movement takes place amongst our resident birds. It is, however, hoped that a system of marking birds by placing an aluminium ring upon a leg with certain distinguishing marks thereon, which has been commenced in many places, will throw some light upon this subject.

We marked a number of birds last year in this way, and if any birds should be found bearing a ring of this sort, we will be pleased to have them sent on to us, with particulars of date and place of capture. Our special mark on the rings is "Carlisle, '09," and number.

There is little to report respecting Mammalia, but Mr. T. Nichol, of Skinburness, came across a Hedgehog in the very act of devouring the young birds in a Thrush's nest. A female Badger weighing twenty-four pounds was caught in a Rabbit-trap near Longtown, and several others were seen or caught in North Cumberland during the year. It is evidently holding its own there. The Slowworm (*Anguis fragilis*) is not a common reptile in the Carlisle district. One was taken at Aspatria on Aug. 18th. and sent to the Museum by Mr. H. Thompson. The following are a selection from the notes and records sent in to the Bureau:—

1909.

January 2nd.—A flock of Snow Geese reported as seen near Annan, on the Solway (Major S. Ferguson).

7th.—Mistle-Thrush heard singing near Windermere (W. E. B. Dunlop). During January, Wild Geese, especially Bean, were numerous; Mallard were very scarce (W. Nichol).

February 2nd.—Five Brent Geese seen near Silloth. They were very shy (W. Nichol).

4th.—Song-Thrush heard singing near Windermere (W. E. B. Dunlop).

11th.—Wild Geese, especially Pink-feet, numerous on Rockliffe Marsh, apparently over two thousand birds; amongst them is a peculiarly light coloured example, presumably a pale variety (Major S. Ferguson).

18th.—A Hawfinch was picked up in a garden at Great Corby. It died a few days later (Mr. Telford).

28th.—The Whooper Swan has at last returned to its old place on the River Eden. It is very late (J. B. Cairns).

March 17th.—Curlews passing over Carlisle (D. Losh Thorpe).

19th.—Two Pintails and twelve Bean Geese near Silloth (W. Nichol).

20th.—Great Spotted Woodpecker seen near Carlisle; Corn-Bunting commencing to sing; large number of Sky-Larks passing over Carlisle on migration (T. L. Johnston). A dark, heavy, misty night; a large number of birds passing over Carlisle on migration. Heard notes of Curlew, Lapwing, Black-headed Gull, and Sky-Lark. A Blackbird struck the high telegraph-wires in Lowther Street (D. Losh Thorpe).

21st.—A flock of Redwings singing in Troutbeck Valley (W. E. B. Dunlop). Large migration of birds continued over Carlisle. Species noted were: Black-headed Gull, Lesser Black-backed Gull, Curlew, Lapwing, Ringed Plover, and Redshank. Mild, misty night; wind S. and S.E. (T. L. Johnston & D. Losh Thorpe).

22nd.—About two hundred Wigeon seen near Silloth (W. Nichol). Badger trapped near Longtown (R. Davidson).

25th.—A Wheatear was seen at Silloth to-day (first record of the season) (D. Losh Thorpe).

27th.—Some Redshanks are frequenting a low-lying meadow near Morton, Carlisle (T. Hutchinson). A Great Plover or Stone Curlew was seen on the River Eden to-day near Caldew Foot. This is the first record of a visit of this species to Cumberland (D. Losh Thorpe).

28th.—Wheatear seen at Silloth (W. Nichol).

31st.—Large number of Blackbirds on migration near Silloth (W. Nichol). First Wheatear seen in Windermere district (W. E. B. Dunlop).

April 1st.—Three pairs of Rooks have built their nests on chimney-stacks of houses at Holme Head, Carlisle (R. Leighton). A Knot in the aviary at Loshville is showing the first signs of summer dress—a few red feathers on the head and neck (D. Losh Thorpe).

4th.—Saw the first Wheatear to-day at Leegate (R. Mann).

5th.—Sand-Martin seen at Rickerby, Carlisle (W. Little).

6th.—Five Pintail Ducks seen at Silloth (W. Nichol). A Swallow seen at Silloth to-day (D. Losh Thorpe).

8th.—A Sand-Martin seen at Silloth (J. J. Hodgkinson). Nine Wigeon seen at Silloth (W. Nichol). Swallows seen at Crosby-on-Eden (W. H. Little). Willow-Warbler seen at Leegate (R. Mann).

9th.—Chiffchaff seen and heard at Middle Gelt (T. L. Johnston). Swallow seen at Crosby-on-Eden (E. Hodgson). Swallow seen at Newcastleton (W. Roden).

10th.—House-Martins and Swallows at Caldew Foot (D. Losh Thorpe). Swallows seen at Skinburness, Silloth (Ernest Carr).

11th.—Eighty to one hundred Wigeon on the Solway, near Silloth (W. Nichol). Swallows, Sand-Martins, and House-Martins are on the Eden (D. Losh Thorpe).

12th.—About fifty Wigeon and thirty Bar-tailed Godwits are near Silloth, on the Solway (W. Nichol). Swallow seen at Scotby (Ernest Carr). Wheatear seen at Silloth (T. W. Sharp).

16th.—Two Swallows seen at Leegate (R. Mann). Willow-Warbler seen at Cotehill, near Carlisle (W. H. Little).

17th.—A large flock of Fieldfares at Leegate (R. Mann).

18th.—House-Martins and Sand-Martins first seen at Windermere (W. E. B. Dunlop).

19th.—Corn-Crake first heard at Cargo, near Carlisle (T. Robinson). Sandpiper seen at Wetheral, near Carlisle (T. L. Johnston). Cuckoo heard at Penton (W. Roden). Willow-Warbler heard first time this year in the Windermere district (W. E. B. Dunlop).

20th.—Cuckoo heard at Cargo, near Carlisle (T. Robinson). Swallows arrived at Troutbeck, Windermere (W. E. B. Dunlop). Corn-Crake heard at Morton, near Carlisle (T. Hutchinson). Swift seen at Etterby, Carlisle (D. Losh Thorpe).

21st.—The Whooper Swan on the Eden appeared restless (it had left the following day) (D. Losh Thorpe). A Redstart, also a Hawfinch, seen at Crosby-on-Eden (E. Hodgson). Cuckoo heard at Leegate (R. Mann).

22nd.—Corn-Crake seen near Allonby. The Black-headed Gulls are hard at work building; only saw one egg (Major S. Ferguson).

23rd.—Corn-Crake heard at Penton (W. Roden). Yellow Wagtail seen at Troutbeck, Windermere (W. E. B. Dunlop).

24th.—House-Martins arrived at Leegate (R. Mann). Redstart seen near Windermere (W. E. B. Dunlop).

25th.—Large number of Swifts arrived at Etterby Scaur, on the Eden. Two were seen on the 24th, and one on the 23rd (D. Losh Thorpe). Tree-Pipit heard and seen at Leegate (R. Mann). Cuckoo heard at Head's Nook (G. B. Routledge).

26th.—Cuckoo heard at Knowefield, Carlisle (L. E. Hope). Cuckoo heard at Troutbeck, Windermere (W. E. B. Dunlop). Cuckoos numerous at Leegate (R. Mann). Corn-Crake heard at Leegate (R. Mann).

27th.—Large flock of Fieldfares at Crosby-on-Eden (E. Hodgson). Grasshopper-Warbler heard at Leegate (R. Mann).

28th.—Whitethroat seen at Troutbeck, Windermere (W. E. B. Dunlop).

29th.—Corn-Crake heard at Head's Nook (G. B. Routledge).

May 1st.—Cuckoo seen at Curthwaite (Ernest Carr).

2nd.—Cuckoo heard at Crosby-on-Eden (E. Hodgson). Some Common Terns seen, and first Lesser Terns arrived on the Solway to-day (W. Nichol).

3rd.—Pied Flycatcher seen at Brathay, Windermere (Rev. T. H. Baines).

4th.—Whinchat seen at Leegate (R. Mann).

5th.—Spotted Flycatchers seen at Annan (Major S. Ferguson).

13th. — Willow-Warbler's nest at Cotehill has five eggs (W. H. Little).

16th.—Pair of Shovelers seen near Silloth (W. Nichol). A Golden Oriole was picked up dead at Brathay, Windermere. It is the first record of this bird for Westmorland. Six degrees of frost the previous night had evidently been too much for this delicate southern bird. It was a young male in the plumage of the second year (Rev. T. H. Baines).

17th.—Young Ravens have left a nest to-day near Windermere (W. E. B. Dunlop).

18th.—Found first Lesser Tern's egg to-day, Solway (W. Nichol).

19th.—Saw two Red-breasted Mergansers near Silloth (W. Nichol). Hedgehog seen devouring young Thrushes in nest, Silloth (T. Nichol).

20th.—Fawn-coloured variety of Starling picked up at Hayton by T. W. Watson, Esq.; sent to the museum by H. S. Cartmel.

June 3rd.—Two Curlew-Sandpipers in summer dress seen on Easton Marsh, Drumburgh (Major S. Ferguson).

21st.—First young Swallow seen on the wing to-day at Leegate (R. Mann).

27th.—Cuckoo heard (last date) near Carlisle (L. E. Hope).

28th.—Common Tern's nest, with eggs, on Solway (W. Nichol).

July 8th.—Common Terns extremely numerous at Ravenglass this year. On this date many of the young had hatched; we marked a number of these chicks by placing an aluminium ring on their legs. The Sandwich Terns here have increased greatly, owing to the strict protection afforded them. In 1889 there were six eggs of this species laid there; this year there were over four hundred (L. E. Hope).

12th.—Nine Bar-tailed Godwits in summer dress near Silloth (W. Nichol). A young Jackdaw in brown plumage, a variety, seen at Leegate. An old bird of the same variety seen several times previously (R. Mann).

August 2nd.—A Willow-Warbler's nest at Windermere contained three half-fledged young (W. E. B. Dunlop).

6th.—A Hawfinch in nest dress was picked up dead at Skirsgill, near Penrith (H. Gandy).

8th.—A Spotted Flycatcher sitting on eggs at this date at Ivegill, near Carlisle. These were subsequently reared, a late brood (Rev. C. T. Phillips).

12th.—A Willow-Warbler singing to-day near Windermere (W. E. B. Dunlop).

13th.—A young Buzzard left the eyrie to-day; very late (W. E. B. Dunlop).

14th.—A male Garganey Duck in eclipse shot on Solway (T. Peal).

18th.—Slowworm caught at Aspatria (H. Thompson).

27th.—Little Stint seen at Silloth (W. Nichol). A Barn-Owl seen in Carlisle (T. L. Johnston).

30th.—Black-tailed Godwit and a Greenshank near Silloth (W. Nichol).

September 2nd.—A Barn-Owl's nest with two young seen to-day, Carlisle (T. L. Johnston).

7th.—About twelve hundred Bar-tailed Godwits seen on Solway (W. Nichol).

11th.—Flock of about forty Bean Geese on Solway (J. Backhouse).

12th.—Whitethroat last seen near Carlisle (L. E. Hope).

15th.—A Spotted Redshank seen near Silloth (W. Nichol).

21st.—Sand-Martins last seen near Windermere (W. E. B. Dunlop).

24th. — Willow-Warbler and Whitethroat last seen near Windermere (W. E. B. Dunlop).

27th.—Song-Thrush uttering fragments of song near Windermere (W. E. B. Dunlop).

29th.—A few Barnacle Geese arrived on the Solway (T. L. Johnston).

30th.—Wild Geese passing over Troutbeck Valley, Windermere (W. E. B. Dunlop).

October 2nd.—A Little Stint seen to-day, also a Peregrine Falcon, on the Solway (W. Nichol).

4th.—Swallows last seen at Windermere to-day (W. E. B. Dunlop). A Red-throated Diver, in summer dress, near Silloth (W. Nichol).

6th. — Saw last House-Martins to-day near Windermere (W. E. B. Dunlop).

8th.—Pair of Pintail Ducks seen to-day on Solway (W. Nichol).

10th.—Three Brent Geese seen on the Solway (W. Nichol).

17th.—Redwings seen for first time this season, Windermere (W. E. B. Dunlop).

19th.—Bramblings seen to-day near Windermere (W. E. B. Dunlop).

25th.—Skein of Wild Geese flying west over Stanwix (L. E. Hope).

27th.—Purple Sandpiper seen near Silloth (W. Nichol).

28th.—Fieldfares first seen to-day near Windermere (W. E. B. Dunlop). Great Crested Grebe shot on Solway (T. L. Johnston). Fourteen Grey Lag Geese seen on the Solway; also a second "gaggle" of twelve (W. Nichol).

November 2nd.—A Long-tailed Duck, an adult male in full winter dress, shot on the Solway near Gretna (J. Broatch).

3rd. — An immature Long-tailed Duck seen near Silloth (W. Nichol).

12th.—Pied variety of Fieldfare seen at High Head Castle, near Carlisle (J. B. Cairns).

13th.—Fifteen Grey Lag Geese seen near Silloth; about sixty Pink-footed Geese at same time (W. Nichol).

17th.—A flock of Crossbills, including several old males in red dress at Windermere. They stayed during the winter (W. E. B. Dunlop). A Red-breasted Merganser on the Solway to-day (W. Nichol).

26th.—Twelve Grey Lag Geese near Silloth (W. Nichol).

28th.—A Bat (Pipistrelle) flying to-day near Windermere (W. E. B. Dunlop).

December 17th.—Small parties of two and four Brent Geese on the Solway to-day (W. Nichol). Four Brent Geese seen on the estuary of the River Wampool (T. Hutchinson).

21st.—Purple Sandpiper seen near Silloth (W. Nichol).

24th.—Four Whooper Swans arrived on the River Eden at Carlisle, one being the bird which has paid us annual visits since 1904. They are all adult birds, possibly two pairs. This occurrence is one of the most extraordinary things in the whole annals of British ornithology. Their arrival was reported by the park keeper (T. Hudson).

THE DRAGONFLIES OF SOUTH-WEST SURREY.

By Gordon Dalgliesh.

Libellulidæ.

Libellula quadrimaculata (Linn.).—This species I found in considerable numbers in the parish of Thursley on a tract of moorland known as Pudmoor, and I have never met with it elsewhere in the surrounding country. During oviposition the female constantly dips on the surface of the water and jerks her abdomen under the water. Dragonflies, with perhaps one or two exceptions, are essentially creatures of the sun, especially the present species. About the middle of June (1909) I visited the spot where I had seen these dragonflies the previous year. The early morning had been cloudy with fitful breaks of sunshine. When I arrived heavy clouds obscured the sun, and I walked to and fro over the ground searching for *Libellula quadrimaculata* in vain; not one was to be seen. I was just giving up the search as useless when out came the sun. Five minutes after the whole place was alive with these Dragonflies, and I can only suppose that previous to this they must have been resting on the rushes in the centre of a large pond. Their flight, like all the *Libellulidæ*, is swift, but does not exceed that of *L. depressa*.

Libellula depressa (Linn.).—Extremely abundant everywhere. There is hardly a pond, however small, that is not frequented by one or more of these lovely insects. Males, I have found, greatly exceed the females in number. Here, at any rate, it is never found far from water. I know of no insect that can rival this in powers of flight, and the only way to capture a specimen is to wait one's chance patiently, and strike quickly with the net the moment it finishes its dashing flight and is hovering. It is almost useless to attempt to catch it unawares when at rest, for, like the proverbial weasel, it seems to sleep with "one eye open."

Orthetrum cœrulescens (Fabr.).—This is decidedly a rare species here, and hitherto I have only been able to take it twice, once by Frensham great pond and on Pudmoor.

Sympetrum vulgatum (Linn.).—Frequently to be seen on the sandy paths that run through the pine woods. It is one of the species that seem to prefer shade to sun.

Cordulia ænea (Linn.).—This Dragonfly I found in large numbers over a pond in Thursley. Its flight is extremely swift; nevertheless, it is comparatively easy to catch any number of them. I found that it had a regular route of flight, and would keep flying round and round the edge of the pond. By waiting quietly at a certain spot for it to come round, and striking just at the right moment, I secured as many specimens as I wanted. If missed, it does not return to the attack so characteristic of *L. depressa*, but dashes off high up in the air, only to return to its given route after a few minutes. It rarely settles like *depressa*, but appears to be on the wing the whole day. I once saw numbers of the small *Agrion puella* chase this species, making repeated dashes at it as it hovered for a few seconds.

ÆSCHNIDÆ.

Both the *Æschna grandis* (Linn.) and *Æ. cyanea* (Müll.) are extremely abundant, and I have seen either one or the other on the wing as late as the middle of October. Locally they are known as "horse-stingers."

CALOPTERYGIDÆ.

Calopteryx virgo (Linn.).—This species, to my mind, is the loveliest of all British insects, and I cannot conceive a sight more pleasing than to see a group of them hovering over the middle of a stream, and in their dancing flight putting one very forcibly in mind of gnats; for they look very much like large azure gnats. The habit of remaining in one particular spot is remarkable, and I have seen one return to a particular twig to rest times out of number. They have a decided preference for running water, and, unlike most Dragonflies, prefer shade to sun. Where thick trees and a tangle of brambles or bushes overhang swift running shallow water, one is pretty certain of meeting with the graceful "Demoiselle." I have on two occasions, however, taken it a long way from any water. *Virgo* is subject to a considerable amount of variation. The female, as a rule, has a white stigma on the fore wing, but frequently this is absent altogether. The wings of the male are a deep shining blue, and I once took a specimen with the left fore wing almost white, though the others were of the normal colour. This Dragonfly generally puts in a first appearance the time the May-fly is "up." This and the next species are the only British Dragonflies that retain their brilliant lustre when dead.

Calopteryx splendens (Harr.). — Unlike the last, this is usually to be found either flying over or resting on the rushes bordering still water. I have not found it nearly so common as the last.

AGRIONIDÆ.

Erythromma naias (Hans.).—This I have found the rarest of Surrey Odonata, and have only taken it twice.

Pyrrhosoma nymphula (Sulz.).—When depositing its ova, this Dragonfly alights boldly on the surface of the water and remains thus motionless with outspread wings for some time. Occasionally it is accompanied by the male insect. I have found the under side of the thorax in this species often covered with a parasitic mite resembling those common on the Dor Beetle.

Lestes sponsa (Hans.), *Agrion puella* (Linn.), *A. pulchellum* (Lind.), and *Ischnura elegans* (Lind.), are all very common, frequently being found consorting together.

The above list must in no way be considered a complete one of Surrey Dragonflies. Doubtless there are many others to be added, but so far I have not been fortunate enough to come across them.

If the wing of a Dragonfly be examined under a microscope with a one-sixth objective, the nervures will be found to be covered with curious protuberances resembling thorns (*cf.* 'Zoologist,' 1908, pp. 458-9). I have often wondered as to what could be the use of these "thorns," and at one time thought they might act as a stiff support to the more delicate portions of the wing,* and as an additional strength, helping the Dragonfly to sustain its powerful flight. But this theory has been considerably weakened owing to the fact that this thorn structure is to be found on the wings of *Agrionidæ*, *Calopterygidæ*, whose powers of flight are weak, and even the fragile *Ephemeridæ*. So for the present its use must remain a doubtful question.

Wishing to dissect the larva of a *Libellula*, to kill it I plunged it into water at nearly boiling-point and left it immersed for half a minute. When taken out, it recovered after a short time and became as lively as ever. If the abdomen of a dead *Libellula* larva be slightly pressed, the "mask" shoots out automatically.

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* *Cf.* "The Adaptions of Aquatic Insects to their Environments," by Gordon Dalgliesh. 'Journal of the Bombay Natural History Society,' November 15th, 1909.

NOTES AND QUERIES.

MAMMALIA.

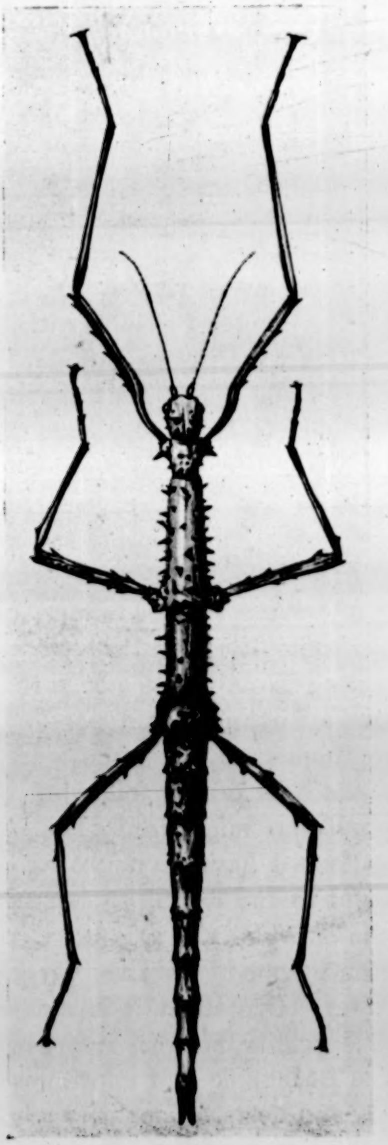
Common Shrew in Islay.—In his "Notes on the Mammals of Islay," published in 'The Zoologist' (*ante*, p. 113), Mr. Harold Russell records the capture of the Common Shrew (*Sorex araneus*) there in 1909, under the impression that the species has not previously been identified from the island. Perhaps, therefore, I may be allowed to draw attention to my record in the 'Annals of Scottish Natural History' for April, 1905 (p. 116) of one caught in Islay the previous year, which has escaped Mr. Russell's notice. — WILLIAM EVANS (Morningside Park, Edinburgh).

AVES.

Nesting of the Wren.—Mr. S. G. Cummings's instance of a Wren's nest which was built in March, left unlined, and not containing eggs until June (*ante*, p. 159), reminds me of a very similar experience here two years ago. In the middle of April a Wren was watched busily constructing a nest under the roots of a tree overhanging the bank of a burn. A month later (May 14th) a bird was flushed from this nest, which was found to contain an incomplete clutch of eggs. What interested me particularly in this case, however, was that the builder was a male, and the nest, when left in April, was a typical "cock's nest." The bird's sex was sufficiently attested by the frequent merry song with which he beguiled his labours. Was Mr. Cummings's nest also built by a male bird? To my mind it has never been satisfactorily shown that the *purpose* of the "cock's nests" is to afford roosting quarters for the grown-up young, although that is no doubt frequently the *result*. Sometimes the original nursery continues to be used as a dormitory after the nesting season is long over, as was the case in an instance last year, when a nest in which a family was reared in late July was still occupied nightly by several birds up to the end of November, and perhaps later. — S. E. BROCK (Kirkliston, West Lothian).

Avocets in Norfolk.—The three Avocets which were mentioned as having been seen on Breydon mud-flats by the watcher there on July 8th, 1909 (*ante*, p. 130), probably went to Blakeney—which is seventeen miles distant by the shore—when driven off by the high tide, for three were seen at that place on the same day, as I learn from Mr. Quintin Gurney. They were not molested at either place, and I have no doubt passed on.

May I correct some mistakes I passed in my recent "Ornithological Report for Norfolk"? On page 128, line 30, the word "France" should be added; on page 131, line 13 from bottom, "Rossitton" should be "Rossitten," the ornithological migration station in the Baltic; and on page 123, "Farmer" should be "Farman."—J. H. Gurney (Keswick Hall, Norwich).



INSECTA.

An Undetermined Species of Stick-Insect found in Devonshire.—A short time ago Mrs. M. F. Arbuthnot, of Fairlawn, Paignton, Devon, sent to the Natural History Museum a species of the group *Phasmidæ*, which had been found in her garden on a climbing rose. She added: "A winged one found has escaped." The winged insect probably had no connection with the specimen before me, as the latter apparently belongs to the apterous genus *Macracantha*, and is possibly the female of the true *Bacillus geisovii* of Kaup (Trans. Zool. Soc. 1866, p. 578), from New Zealand, which is certainly distinct from the insect described by Hutton under that name, and subsequently re-named by him *Acanthoderus suteri*. The synonymy is given in my 'Synonymic Catalogue of Orthoptera' (vol. i. p. 340). See also Brunner von Wattenwyl and J. Redtenbacher, 'Die Insekten familie der Phasmiden' (pp. 238, 239), who also write the two species under the name of *Acanthoderus geisovii*. There is a defective specimen of another closely allied species in the Natural History Museum from Stewart Island, apparently distinct from any of those recognized by Hutton.—W. F. Kirby.

Notes from South-west Hants.—In this neighbourhood the summer of 1909 will be long remembered as a very disappointing period in the pursuit of natural history objects, especially entomological; and the winter following was none the less uncertain from an ornithological point of view. The cold nights in July were very much against the success of the moth collector, and most of the generally common species of butterflies were restricted in numbers, except perhaps the two whites—*P. brassicæ* and *P. rapæ*—the larvæ of which were all too common upon the cabbage tribe, entirely destroying the crop in some localities. Again, the past winter has been somewhat abnormal both in weather and temperature; Bats abroad in January, Blackbird singing, and eggs and young Thrushes in February are not of frequent occurrence even in our uncertain climate. Referring to the spring of 1909, we find the Swifts put in an appearance in very strong force and unusually early, but later in the season scores perished with the cold. Other members of the Swallow tribe were not so abundant as usual, but a comparatively good number of the Nightjars were to be seen and heard of an evening, and I am glad to say at the same time the welcome "crake" of the Land-Rail was occasionally detected; although once so common, this strange note had been very scarce, if not entirely wanting hereabouts, of late years. Of the other summer visitors, a fair sprinkling occurred—all except the Nightingale, whose notes were much more scarce than usual; some three summers ago the birds sang and might have nested in some of the gardens close to Ringwood. Early in June the migrating Hobby was not rare: I knew of three being slaughtered within a fortnight, and possibly a pair nested in a certain wood, as they frequented the same locality throughout the summer, and yet I did not hear of any following the Swallows, as they often do in their autumn migration. That the Shoveler also bred in the valley of the Avon I have no doubt, as the description of Ducks occasionally brought to me during the summer could apply to none other than the male Shoveler, and as a more conclusive proof quite young birds were seen by one of the river keepers, who also saw young Teal upon the water. Of course, it is not the first time either species has nested in the locality, but it is interesting to know they still do so, if rarely. The Redshank still continues to visit us, perhaps in increasing numbers, and nests in localities where a few years ago it was a stranger, its eggs being often sold as those of the Peewit; large flocks of the latter bird were seen passing to and fro, but fewer nests than usual were found, and throughout the summer and autumn I heard of but one Peregrine Falcon preying upon the Plovers at any time, which was not the case in former years. As the winter advanced, a large number of Golden Plover were seen at times frequenting the same locality as the Peewits, but their stay was not prolonged—possibly the flooded meadows were not agreeable to them—and if settling upon a favoured spot in company with or near their crested relatives, the two species invariably separated on rising and flew in opposite directions.

At the end of September an immature female of the Honey Buzzard was killed. It was in dark plumage, various shades of brown predominating, especially upon its long and beautiful tail. Its stomach was quite empty and body scantily nourished, but its plumage was clean and bright, and not in the condition one often sees in a lean, semi-starved creature. The river being in flood most of the winter the conditions were unfavourable both for gun and rod. Teal were scarce, and Wigeon only in fair quantity; Snipe were often abundant, but no extraordinary "bags" were made, and, although a goodly number of Mallard were upon the water, only a few Pochard, Tufted Duck, and Shovelers were seen or shot; whilst such species as Gadwall, Goldeneye, Goosander, &c., were very rare or altogether wanting. Indeed, on some parts of the river the wildfowl shooting was almost abandoned, not so much from the recognized paucity of birds as from the difficulty of getting near them, and in one sense this was fortunate, as the mild open weather had induced many of the Duck tribe to show signs of the coming duty of nesting—by frequent squabbles amongst themselves, and *pairs* rising and flying around the noisy group below—and it seems the height of folly when creatures are killed at such a time. Unlike the reported abundance of Wild Geese upon the east coast and in some parts of Ireland, very few visited us, and were seen during two or three of the milder days at the beginning of February flying over the inundated meadows, but they soon disappeared, and were not seen again when the waters had somewhat abated, and the weather was much more severe.

Several Bitterns frequented the same locality, and one if not two were killed at distant points; but now more than formerly a better state of feeling for the protection of this beautiful and interesting species seems to prevail in many quarters, and quite rightly too, as often the birds were killed just for the sake of "killing something"; and the same remark may be applied, with the same or greater force, to the most lovely of all our birds, *viz.* the Kingfisher, which I am glad to say has increased considerably during the past few years. It is also interesting to know that a heronry in the neighbourhood is still flourishing, notwithstanding the persecution accorded the grand old birds if they wander far from their protected home. As to the smaller winter visitors, I did not hear much of either Siskins or Lesser Redpolls, but Bramblings and Crossbills were conspicuous at times in suitable localities, the former foraging amongst the "beech-mast," and the latter favouring the "conifers"; both species are rather uncertain in their visits, but generally occur in greater or lesser numbers, the past winter being especially favourable, and yet I have known of very few being shot; in fact, the only one was a specimen a man described as "a red bird with a deformed bill, crossed like the 'nippers' we formerly used for holding Eels."

The river having overflowed its banks so often, the angling successes have been few and far between. As usual, some fine Roach and Perch were taken, and large Chub were to be had; but at the opening of the Salmon season in February no fish was taken in the upper parts of the river for several weeks, and very few since have fallen to the lot of the most expert angler. I was told that a very fair number ascended for spawning in November and December, but few "fresh run" fish seem to have come very far up the stream for the present; perhaps when the "prawn" bait is used in May things will be more promising. Several large Pike, ranging from 20 lb. and upwards, were taken, and one angler told me he caught ten in one day, the largest—which I saw—weighing 22 lb., and the next in weight 18 lb., the rest were smaller, ranging from 3 lb. to 6 lb each.—G. B. Corbin (Ringwood).

P.S.—Two fine female Badgers were captured, at the end of March, in a locality where only Foxes were suspected, and several of the cream-coloured variety of the Mole have been met with, but I have not heard of or seen a Stoat in white or dappled coat the whole season.—G. B. C.

BRITISH 17 JN 10 MUSEUM